

## —EXHIBIT—

Fig. 1a

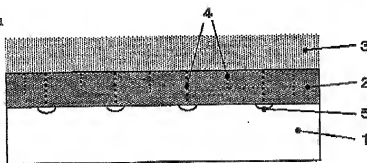


Fig. 1b

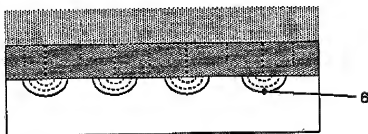
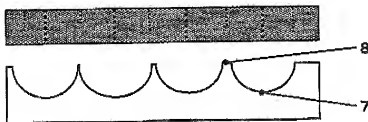


Fig. 1c



- 1: Quartz glass substrate
- 2: Thin film
- 3: An HF solution or a fluorine-containing atmosphere
- 4: Penetration portion
- 5: Etching starting portion
- 6: Portion where isotropic etching proceeds
- 7: Spherical or elliptical concave
- 8: Convex

[0010]

One example of the production method for quartz glass according to the present invention is shown below. Namely, the example is a production method comprising coating a material which forms a thin film on the surface of quartz glass by using coating means such as a spinner, bar coater, applicator, curtain flow coater, etc. so as to give a film thickness not exceeding 100  $\mu\text{m}$ , preferably from 0.1 to 10  $\mu\text{m}$ , and after drying subjecting the coated glass to etching treatment in an HF solution or in a fluorine-containing atmosphere. In cases where the film thickness exceeds 100  $\mu\text{m}$  in the aforementioned production method, the film would not peel off by the etching treatment in an HF solution or in a fluorine-containing atmosphere, whereby the portions where the film was formed are not etched to remain and fails in forming spherical or elliptical convexes and concaves, and moreover unfavorable non-uniform etching takes place. Further, for a film thickness below 0.1  $\mu\text{m}$ , the film tends to peel off in a short time in the etching treatment in an HF solution or in a fluorine-containing atmosphere, convexes and concaves are not formed in the surface of the quartz glass. As a preferable etching condition, for example, a treatment with a 5% HF solution for 30 min or one with a 26% HF solution for 10 min is mentioned, whereby, when the film thickness is large, it is necessary to extend the time of etching treatment. In addition, as a fluorine-containing atmosphere,  $\text{SF}_6$ ,  $\text{NF}_3$  and the like are mentioned.

[0011]

The mechanism with which spherical or elliptical convexes and concaves are formed in the surface of the quartz glass via the etching treatment in the aforementioned HF solution or fluorine-containing atmosphere is considered as follows: though etching is suppressed at the

portions where the film is formed, in the case where the film is thin, the HF solution or fluorine-containing atmosphere penetrates along the molecular shape of the film to partly etch the glass surface. Accordingly, formation of spherical or elliptical convexes and concaves is difficult when the film is thick whereby the HF solution or fluorine-containing atmosphere cannot penetrate to the surface of the quartz glass.